Questions & Answers
Underground Injection Control Induced Seismicity
Technical Report
June 2013

1. Why did EPA develop this report?
   There have been several recent cases where wells regulated by the Underground Injection Control Program were suspected to have contributed to earthquakes. In response, EPA's Office of Ground Water and Drinking Water asked a State-EPA UIC National Technical Workgroup (NTW) to develop a report of technical recommendations addressing induced seismicity related to UIC Class II wastewater disposal wells.

   When complete, the seismicity report will provide practical approaches for permit writers to consider when permitting new wells or updating existing wells. It is not guidance, and does not update or interpret regulations. The State-EPA UIC National Technical Workgroup collected and reviewed relevant scientific literature, evaluated case study areas, and explored petroleum engineering approaches as a new way to analyze available data.

2. Who compiled this report and who has reviewed it?
   The State-EPA UIC National Technical Workgroup was established in 1997 to foster staff-level exchange of technical and programmatic information specific to the UIC program. It is comprised of staff from each EPA Regional Office, OGWDW, and six members from states authorized to implement the UIC program. The draft report entitled, *Minimizing and Managing Potential Impacts of Induced Seismicity from Class II Disposal Wells: Practical Approaches* was developed by a subgroup that included additional states with expertise in the area of injection-induced seismicity. When the draft technical report is complete, EPA plans to submit the report for independent, external peer review.

3. EPA completed the draft report in 2011. Why has nothing been done with it yet?
   The draft is not complete. The National Technical Workgroup continues to work on the report. In December, 2012 the State-EPA UIC National Technical Workgroup sought input on the draft technical report from a group of technical experts who had either contributed data to the report or had been the authors of papers on which the report was based. The Workgroup is currently in the process of evaluating comments from these contributors. EPA plans to submit the draft report for independent, external peer review later this year. The document could change substantially as the workgroup addresses comments from reviewers.

4. Can underground injection of oil and natural gas production fluids cause earthquakes?
   Yes. Current information suggests that in rare circumstances, if the right combination of subsurface conditions is present, injection of oil and gas wastewaters can cause earthquakes that can be felt at the surface. Historically, the vast majority of injection induced earthquakes were too small to be felt.

5. How long has EPA known this?
   Induced seismic activity has been documented since at least the 1920s and has been attributed to a range of human activities including the impoundment of large reservoirs behind dams, controlled explosions related to mining or construction, withdrawals of oil, gas, and other minerals, and underground nuclear tests. In addition, underground injection can create induced seismic events that can be felt at the earth's surface. Historically, induced seismicity has generally been so small in magnitude that it is often undetected. Over the last few years, the Agency has become aware of induced seismicity that can be felt at the surface in the vicinity of UIC Class II wells.

6. Is EPA concerned about injection induced earthquakes?
   EPA is concerned because earthquakes, depending on the magnitude, can endanger underground sources of drinking water (USDWs) by damaging injection well casings and/or creating conduits in the subsurface where contaminants can enter USDWs. This concern led EPA to incorporate protective provisions into the regulations for UIC Class I wells when they were developed in the 1980s. We believe it is possible to address concerns by alerting UIC permit writers about the practices that can cause earthquakes and providing them with information on how to minimize the possibility of earthquakes in the future.

7. What circumstances lead to injection induced earthquakes?
   Available literature identifies three site characteristics believed to be necessary for significant injection induced earthquakes: (1) stressed faults, (2) subsurface pressure buildup from disposal activities, and (3) a pathway for increased pressure on the stressed fault. It is rare for all three of these characteristics to be present at the same time, but when they are all present, the likelihood of an earthquake increases substantially.

8. Will EPA use its discretionary authority to place additional conditions on permits for underground injection to prevent earthquakes?
   EPA expects that UIC permit writers will continue to make decisions on a case by case basis, specific to each well and location. If circumstances warrant additional permit conditions, a permit writer would likely add conditions to the permit.

9. Will EPA develop regulations specific to seismicity?
   Existing regulations for UIC Class I and VI wells already include explicit requirements related to seismicity. Other well classes allow for additional conditions to be added to injection permits on a case-by-case basis, at the discretion of the permitting authority. EPA does not have plans to issue new underground injection well requirements to address induced seismicity.

10. Have induced seismicity events endangered drinking water sources?
    Existing regulations for UIC Class I and VI wells already include explicit requirements related to seismicity. Induced seismicity related to UIC wells is rare and EPA is not aware of any induced seismic events which have resulted in contamination of drinking water sources. As unconventional sources of energy are tapped and new technologies employed, the number of production wells and the amount of waste water they produce has increased. This, combined with an expansion of geographic areas under development, has increased public concern and increased states regarding seismicity. This increases the importance of taking appropriate measures to prevent endangerment of drinking water sources.

11. What does the report say?
    The draft NTW report identified components necessary to induce seismicity and found that the likelihood of all components occurring at the same time is low but difficult to predict. The NTW found no single recommendation that would address all the complexities related to managing or minimizing injection-induced seismicity. The report includes a variety of recommended approaches in four categories: site assessment, well operation, monitoring and management.